Ownership and wages: Spatial econometric approach

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Abstract: The aim of our paper is to disentangle the relationship between ownership and wages using cross-section data for Slovenian medium size and large companies, where we account for spatial dependencies in wage determination. Space here is not considered in geographical context, but as a set of relations between firms originating from the same owner. Using a detailed database on Slovenian ownership, we apply a spatial econometric approach to detect any ownership-based wage spillovers, while accounting for different standard factors, such as size, capital intensity and productivity, and also some ownership-based variables, such as ownership concentration and ratio of cash-flow to control rights. Our results indicate that ownership is an important factor in explaining differences in wage levels. Many large owners divert cash-flow into their own pockets which has a detrimental effect on wages and indicates that this behaviour induced by owners is not sustainable.

Keywords: spatial econometrics, ownership, wage differentials, sustainability.

1. Introduction

"In theory, the ownership of a business in a capitalist economy is irrelevant. In practice, it is often controversial« (The Economist, 2010). Economists have long neglected the ownership of corporations in their empirical work, mostly due to the lack of precise data on ownership structure and the lack of an appropriate method to incorporate it in the empirical work. Although some attempts are found in the literature, most of them try to a priori group capital owners into specific groups such as state, domestic, and foreign ownership. If however we assume that these groups are not homogeneous at all, it is not surprising that no proper conclusion has been made. In this paper we try to overcome these problems by introducing a connectivity of firms on the basis of ownership. Ownership of each firm is traced to individuals where possible and tested whether firms with same owners perform similarly with regards to wages.

Differences in wages are results of different factors usually associated with economic and institutional environment. Wage gaps have been intensively studied by Buckley and Enderwick (1983), Blanchflower (1984), Globerman et al. (1994), Oulton (1998), Feliciano and Lipsey (1999), Girma et al. (2001), Gosh (2009). The main factor in these studies was labour productivity (Buckley and Enderwick, 1983). Due to technological factors, companies employing highly skilled and educated labour force would thus pay relatively higher wages compared to low tech firms, which are usually differences between foreign and domestic firms (Doms and Jensen, 1998). Better technology translates higher productivity into higher wages. This line of reasoning is in line with neoclassical theory, which argues that higher wages signal better firm performance (Winter-Ember and Zweimüller, 1999).

On the other hand, wage increases stimulate workers to produce more (i.e. raise labour productivity). While technology is difficult to measure, capital intensity according to Globerman et al. (1994) and Feliciano and Lipsey (1999) is another factor which contributes to explaining wage gaps between foreign and domestic firms, because lower wages might reduce employment. Globerman et al. (1994), after controlling for capital intensity and firm size, find that differences in wages associated with ownership disappear, which is additionally confirmed by Feliciano and Lipsey (1999) on the US manufacturing sector.

For the purposes of studying effects of ownership on corporate policies we introduce a capital connectivity matrix, which is based on direct and indirect ownership shares in Slovenian medium size and large corporations. With the use of spatial econometric tools we try to answer the question of relevance of ownership, by looking at the similarities between firms that are owned by the same individual. Our hypothesis is that different (individual) owners have different effects on wage levels in firms. We test this hypothesis via spatial error model and expect a positive spatial autocorrelation coefficient. This implies that differences in wages are not a sole result of differences in productivity, capital intensity, and size, but are additionally set by the owners of the firms.

The remainder of the paper is organized as follows. Section 2 provides an overview of the literature on ownership and wages. In Section 3 we introduce basic elements of spatial econometrics. Capital connectivity matrix, which uses information on individuals' direct and indirect ownership shares, is presented in Section 4. Section 5 contains results of spatial regression, with concluding remarks in Section 6.

2. Ownership and wages

The main factor producing the wage gap is productivity, which is a consequence of higher skilled labour force, working in high-tech firms and, according to the existing literature, is not associated with ownership but rather with factor intensity and firm size. On the other hand some authors have found that there is some linkage between ownership and corporate wage policy, since changes in ownership structure are accompanied with important consequences for corporate governance (Shleifer and Vishny, 1997). Effects of ownership concentration on firm performance have its roots in contributions from Berle and Means (1932). Although empirical studies have shown, that higher ownership concentration, measured as a share of largest blockholder, has a positive effect on performance (Cubbin and Leech, 1983), there was no theoretical background at the time for such findings. Demsetz (1983) argued that ownership structure is an endogenous result of competitive selection with a single goal of profit maximization expected by their owners; hence changes in ownership structure cannot affect firm performance. Accordingly, Demsetz and Lehn (1985) could not confirm any relationship between concentration and performance in US corporations.

Modern theory of corporate governance has evolved from earlier workings of Berle and Means (1932), with its pillars in dispersed ownership, which is well seen in the Theory of the Firm (Jensen and Meckling, 1976) and in contribution from Grossman and Hart (1980). Unique institutional environment (Roe, 1994; La Porta et al., 1997) that gave ground to the theory of a firm has its' origins from English speaking countries such as US and GB. This uniqueness of institutional environment provides a rather dispersed ownership structure, meaning that ownership concentration is low and portfolio investors play a large role. Such factors are rarely found in the rest of the world where investor protection is low, ownership concentration high, which in turn makes identity of large owners (blockholders) an important factor.

At that time the empirical validity of dispersed ownership with strong managers and weak owners (Roe, 1994) view was being questioned by authors such as Eisenberg (1976), Demsetz (1983), Demsetz and Lehn (1985), Shleifer and Vishny (1986), Holderness and Sheehan (1988), Morck et al. (1988), La Porta et al. (1999), who have shown that even in US corporations there exists a moderate ownership concentration, while in the developing countries ownership is even more concentrated (La Porta et al., 1999). Shareholders in those countries have significant shares, which they use to actively influence corporate governance (Kang and Shivdasani, 1995). Active owners contradict Bearle-Means thesis as well as Roe's view on weak owners. La Porta et al. (1999) argue that identifying ultimate owners and associated voting rights is the only way to reveal the relationship between ownership and control. Controlling shareholders, who are often either state or a family, are present in most of corporations and their control rights exceed cash-flow rights. A "better" ratio of cash-flow to control rights is most often achieved through pyramid structure based on the theory of pyramidal ownership and family business groups (Almeida and Wolfenzon, 2006), and with participation in management (La Porta et al., 1999). Better ratio of cash-flow to control rights, gained through pyramid structure, allows controlling shareholder to divert cash-flow to their own pockets.

3. Brief introduction to spatial econometrics

Shareholders, either large or small, are not randomly (and independently) distributed, since they can choose where to invest. According to their share they have voting rights, which they might influence firms' governance. Thus we can assume that firms are not independent units. According to Kmenta (1997) independence is the most unreasonable assumption in many cross-section studies. Maddala (2001), while studying households, further explains that residuals can be spatially correlated most likely due to omitted variable. Spatial correlation implies existence of similar value in the neighbouring units. The first law of geography says that "everything is correlated with everything else, but close things are more correlated than things that are far away" (Tobler, 1970).

In Euclidian space neighbourhood is defined with a distance measure:

$$d_{ij} = d(s_i, s_j) = \sqrt{(s_i - s_j)^T (s_i - s_j)} \qquad (1)$$

where d_{ij} is a distance between points s_i and s_j. Most used definitions of neighbourhood are critical distance and n-nearest neighbours. Critical distance defines two points in space as neighbours if their distance is less than some cut-off distance $\bar{d}$. According to this definition points s_i and s_j are said to be neighbours if $0 \leq d_{ij} < \bar{d}$. Usally cut-off distance is defined as $min\left(max\left(d(s_i, s_j)\right)\right)$ in order that each point has at least one neighbour. Similarly, two points are said to be nearest neighbours if $d_{ij} = \min(d_{ik}) \forall i, k$, where k is an arbitrary integer number referring to the number of nearest neighbours.

With distance (d) and neighbourhood (N) properly defined, we can introduce a key concept of spatial econometrics, the spatial weights matrix (also known as a spatial connectivity matrix or W-matrix), which formally defines relationships between all points. Elements of a W-matrix are defined as:

$$w_{ij} = \begin{cases} \omega & if\ j \in N(i) \\ 0 & if\ j \notin N(i) \end{cases}, \ j \neq i \qquad (2)$$

After defining a W-matrix, it is usual practice to standardize it in order to confine a coefficient of spatial correlation to (-1,1) parameter space. A family of standardization techniques is defined as (Tiefelsdorf and Griffith, 2006):

$$V_{[q]} = \frac{n}{\sum_{i=1}^{n} d_i^{q+1}} D^q B \qquad (3)$$

where B is binary spatial weight (1 for neighbours and 0 otherwise), D^q matrix with spatial weights elements, d_i^q, n number of units, and q an element defining standardization. Some of the most common ways of standardization are (Patuelli et al., 2006):

i. Q = 0. C-scheme or globally standardized spatial weights matrix is used when there are large differences in connectivity (different number of neighbours) between units and these need to be expressed. C-scheme also makes W-matrix symmetrical.
ii. Q = -1. W-scheme or row standardized spatial weights matrix is most common and has an opposite effect to the C-scheme. It emphasizes points or areas with less connectivity at the edges of space.
iii. Q = -0,5. S-scheme or variance stabilizing coding scheme (Tiefelsdorf et al., 1999) is right in between the first two, since it diminishes the differences with regards to connectivity.

With W-matrix defined and standardized, we can now introduce spatial models. Most spatial models come in variety of Cliff-Ord type models (Cliff and Ord, 1981). On one hand such models incorporate spatial lag of the dependant variable, while on the other a spatial autocorrelation of the residuals. Spatial lag model is defined as:

$$Y = \rho WY + X\beta + \varepsilon, \; \varepsilon \sim N(0, \sigma^2 I), \qquad (4)$$

while spatial error model is defined as:

$$Y = X\beta + \lambda Wu + \varepsilon, \; \varepsilon \sim N(0, \sigma^2 I). \qquad (5)$$

Combination of both spatial lag and spatial error produces the following SARAR model:

$$Y = \rho WY + X\beta + \lambda Wu + \varepsilon, \; \varepsilon \sim N(0, \sigma^2 I) \qquad (6)$$

SARAR stands for Spatial AutoRegressive (lag) AutoRegressive (error) model. If we only take first order neighbour then we can write it as a SARAR(1,1). Accordingly we can rename spatial lag model as SARAR(1,0) and spatial error model as SARAR (0,1). SARAR can be estimated with Feasible Generalized Spatial two-stage least squares (FGS2SLS), a procedure developed by Kelejian in Prucha (1997; 2007, 2010), which is a combination of GM and IV estimation.

Although model (6) is well established in spatial econometrics literature, most regional scientist follow an approach, where they first estimate OLS regression and later try to determine whether the true data generating process is a spatial error, or a spatial lag model. Kalejian and Prucha (1998) believe that testing a joint hypothesis of no spatial spillovers originated from the endogenous variables or from the disturbances is superior, since model (6) allows for much richer spatial patterns. Even if corresponding spatial coefficients turn out not to be statistically different from zero, one could still estimate a reduced model (Piras, 2010)

4. Capital connectivity matrix

With basic elements of spatial econometrics defined, we move to the capital connectivity matrix. Before using real data, it's best to present a simplified version of the ownership structure data. In Table 1 there are 4 firms and 3 owners, each firm with 2 owners (O_A and O_B) and their share of stock C. Since we do not deal with geographical space but a space where relationships between points are defined with ownership of capital, we named it "*capital space*".

Table 1: Example of the ownership data

Firm	O_A	O_B	C_A	C_B
1	1	2	C_1	$1-C_1$
2	2	3	C_2	$1-C_2$
3	3	1	C_3	$1-C_3$
4	2	1	C_4	$1-C_4$

Source: Ogorevc and Šlander Wostner, 2011

In capital space a pair of firms are said to be neighbours if they have a common owner or in other words, if they are placed in the owners' neighbourhood *N(i)*. Elements of the matrix are defined as:

$$w_{ij} = \begin{cases} \omega = C_{k,i} * C_{k,j} & if\ j \in N(i) \\ 0 & if\ j \notin N(i) \end{cases}, j \neq i. \qquad (7)$$

Where $C_{k,i}$ denotes share of owner k in firm i and $C_{k,j}$ denotes share of owner k in firm j. According to the Table 1 we can see that firm *F1* has 4 relationships: two originating from owner *O1* and two from owner *O2*. Since firms *F2* and *F4* have the same owners (O1 and O2) we summed weights of a pair *F(1,4)* which lead to the following specification of the matrix.

Table 2: Example of non-standardized capital W-matrix

F	1	2	3	4
1	0	ω_3	ω_1	$\omega_2 + \omega_4$
2	ω_3	0	ω_7	ω_6
3	ω_1	ω_7	0	ω_{10}
4	$\omega_2 + \omega_4$	ω_6	ω_{10}	0

Source: Ogorevc and Šlander Wostner, 2011

Using real data on ownership presents a difficult task, since we first need to calculate direct and indirect ownership shares for each individual owner. It is not uncommon to find the use cross-shareholdings, pyramid structures and other techniques to achieve a better ratio of cash-flow to control rights and also to hide real ownership information. One such example is shown in Figure 1, which reveals the ownership structure of joint stock company Alukomen d.d. On the first level of ownership structure (direct ownership) we can see that there is a majority stockholder Alumen montal d.d. with 76.11% of shares. Second largest owner with less than 1% is an individual and same goes for the third and so forth. We can say that Alukomen d.d. is controlled by Alukomen Montal d.d. On the second level we can see that the largest shareholder (blockholder) of Alukomen d.d. is Kraški zidar d.d. with 11.11%, followed by the company itself with nearly 10% and also a cross-shareholding by Alukomen d.d with 8.6% ownership. Other shareholders are Fin Impex d.o.o., owned by individual *X1* with 7.64% and Primorje d.d., owned by Primorje holding d.d., for which ownership structure information was not available.

In order to calculate direct and indirect ownership shares we used two databases. First one contained ownership information of Slovenian joint stock companies with information limited to those, who traded at least one share. Ownership data for joint stock companies was provided by the Central Securities Clearing Corporation (KDD) for the top 50 holders at the end of the march 2009. For limited liability companies we used Business register of Slovenia (PRS) provided by AJPES. Although PRS contained ownership information for a longer time period, we matched it to coincide with a date of KDD top 50 data.

Procedure for calculating direct and indirect ownership shares was a four-step routine with iteration of the final step, while at each step limiting the number of owners to 50 in order to reduce computation time:

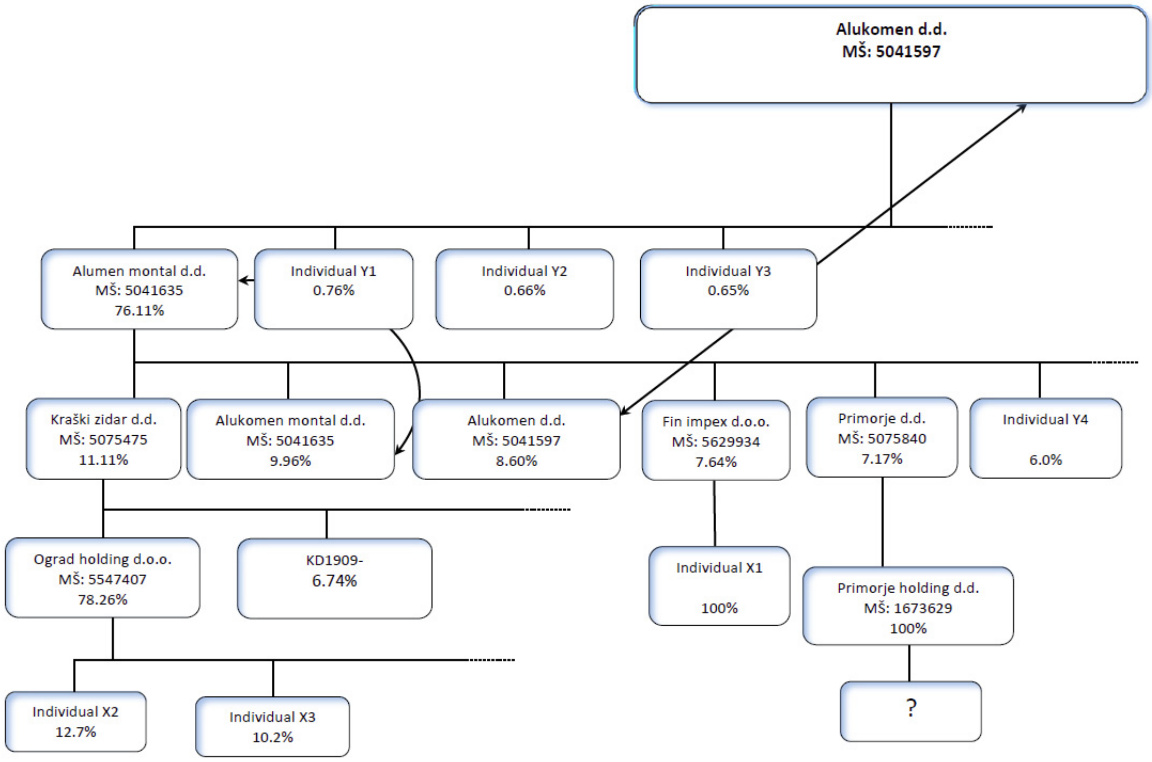
i. First step was used to obtain direct ownership shares of companies; which is the case for first level (direct) ownership in Figure 1.
ii. In the second step all owners that are limited liability companies were replaced by their owners in order to obtain individuals, joint stock companies or foreign firms for which we did not have data on ownership structure. Looking again at Figure 1, Fin

Impex d.o.o. was replaced by individual X1 and Ograd holding d.o.o was replaced by individual X2, X3 and so on.

iii. The third step was similar to the second but this time all the direct owners of joint stock companies were replaced by their owners.

iv. The goal of the final step was to account for cross-shareholdings and for companies holding their own stock. Again, looking at Figure 1, since Alumen montal d.d. has its' own shares, they were replaced by the owners of Alumen montal d.d. This was done iteratively for as long as the Alumen montal d.d. remain its own shareholder above 0.00001%. At the third step of the procedure Alumen montal d.d. had 9.96% of its own share. Starting the forth step, it share was diminishing from 0.0099% then 0.000098%, 0.000000009%, at which time the iteration procedure would stop and changing that number of ownership share to 0.

Figure 1: Ownership structure of Alukomen d.d.



Source: KDD, 2010; AJPES PRS, 2011; own calculation

In the case of illustrative example from Figure 1, combined direct and indirect ownership shares reveal the following top five owners (in Table 3). Based on this information we computed ratio of cash-flow to control rights by comparing the control rights of direct owners to cash-flow rights of largest indirect owners. Computation of the ownership concentration measure (C4) was done by summing the top four owners' shares. Again, due to data limitation both measures are imprecise since we did not have all the necessary information on ownership for some corporations. Many of these corporations, which are large shareholders, were treated as a single individual (e.g. Primorje holding d.d.).

Table 3: Top 5 owners of Alukomen d.d.

Individual X1	Primorje holding d.d.	Individual Y4	Individual X2	Individual X3
6.78%	5.46%	5.36%	4.90%	3.93%

Source: KDD, 2010; AJPES PRS, 2011; own calculation

Combination of direct and indirect ownership shares were then used to produce a capital W-matrix. Using an example data from table 1 we have shown, that elements were computed using a product of ownership shares while accounting for the ownership information with summation of ownership shares in a given firm. For an easier overview of ownership structure of Slovenian medium size and large companies we present assets and labour cost multiplied by direct and indirect ownership shares for the first 10 largest owners in the sample, sorted by labour costs. It can be seen from Table 4 that Slovenian state, with a portfolio of 280 investments controls more than one third of all the assets in the economy's medium size and large companies, while its share in labour costs is about a fifth. Due to sample restrictions or owners uniqueness these shares tend to be inflated in the sample and producing values for assets and labour 42% and 31% respectively. It should be mentioned here that municipality ownership is not included in the ownership by the Republic of Slovenia, although it is a part of the state ownership. Largest of the municipalities is Ljubljana with 1% both in assets and labour costs, while all municipalities combined control about 2% of assets and 3.5% of labour costs with 466 investments. Second largest owner measured by assets is a Slovene entrepreneur who controlled 2.3% of assets and 1% of labour costs. Ownership information for the rest of the top 10 list could not be traced to individuals due to database limitation.

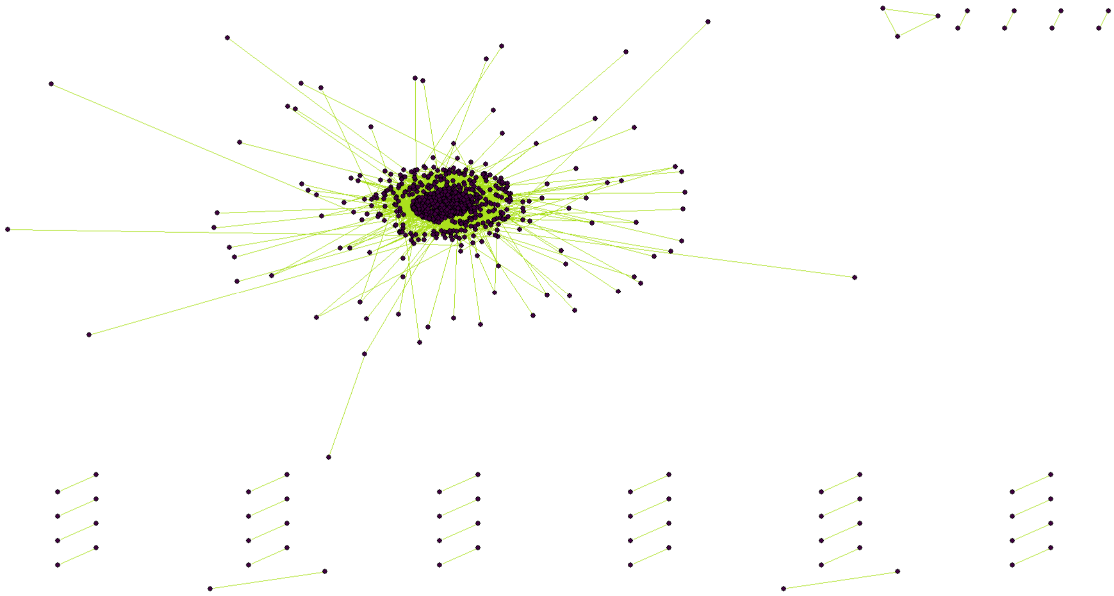
Table 4: Top 10 owners by labour costs in the sample

		economy		sample	
Name	N	Assets	Labour costs	Assets	Labour costs
R. Slovenia	280	33.84%	21.39%	41.85%	30.65%
Ag Novartis pharma	4	1.70%	2.24%	2.12%	3.22%
M. Ljubljana	14	0.97%	0.99%	1.21%	1.43%
Center naložbe, d.d.	27	1.30%	0.92%	1.62%	1.31%
Entrepreneur	9	2.30%	0.99%	2.70%	1.24%
Primorje holding d.d.	33	0.84%	0.88%	0.91%	1.14%
Dilon coöperatief u.a.	9	0.66%	0.66%	0.82%	0.95%
Hidria, d.d.	12	0.49%	0.53%	0.61%	0.77%
Siemens aktiengesellschaft	82	0.45%	0.52%	0.56%	0.75%
Infond holding, d.d.	18	0.64%	0.46%	0.80%	0.66%

Source: KDD, 2010; AJPES PRS, 2011; own calculation

Another way of looking at ownership information is by drawing it on a two dimensional space. Figure 1 was drawn with software Pajek using Kamada-Kawai separate components technique (Kamada and Kawai, 1989), where distances between points represent capital spatial weights. Similar to the Table 4, we can observe a concentrated ownership in the middle of Figure 2 as a result of a state ownership. Points that are further out are indirectly less connected to the state's portfolio than the ones in the inner circle, while the separate components present firms with no ownership ties with the state. The main insight of the Figure 2 compared to Table 4 is the finding, that the Slovenian government has potential control of the economy beyond what it can be seen from the Table 4. Namely only 63 firms in the sample are totally independent from the highly connected centre.

Figure 2: Graphical representation of capital W-matrix



Source: KDD, 2010; AJPES PRS, 2011; own calculation

Standardization of capital W-matrix was a combination of row standardization (W) and variance stabilizing scheme (S). W-coding was first used in order to confine spatial correlation coefficients to (-1,1) parameter space. Using only this coding is problematic in the case of capital W-matrix since a pair of firms are said to be neighbours if they have a common owner. A problem of row standardization can be shown in the following example. Imagine we have only two pairs of neighbouring firms, each pair connected through a different owner and all other owners of the four firms are unique. Then suppose that owner of the first pair connection has a 100% share in both firms, while the owner of the second pair has only 5% share in one firm and 10% share in the other. Without any standardization the weights of the first pair would be 1 and only 0.005 for the second. Row-standardization in this case would lead to weights equality, which is not correct since change in the low shareholding pair would mean that only the non-unique owner can influence firms' governance. For that reason we applied a correction factor, which is equal to the sum of non-unique owners' shares in a given firm. Also, the correction factor was different in the (5%, 10%) pair, which made connectivity matrix asymmetric. Because of the use of the correction factor, parameter space was no longer confined to (-1,1) and for that reason amongst the others we used S-coding scheme in the second step. But why didn't we use only S-coding? The answer to that lies in the varying size of portfolio of the owners. If we take two extremes; one owner has shares in 280 firms, while the other only in 2 and for ease of interpretation we assume that the two owners have each 100% in all of their firms. Then the weights for the larger owner would be much higher than those of the smaller one. Using a combination of corrected row-standardized S-coding scheme thus confines spatial correlation parameters to (-1,1) while accounting for the information lost due to unique owners.

5. Empirical evidence

The core of this study is to provide some empirical evidence on whether owners affect corporate policies in a detectable manner, in this case the corporate wage policy (or wage setting) using capital W-matrix and a simple statistical model with labour cost per worker as a dependant variable and a set of independent variables most commonly found in the literature. We present these variables in Table 5.

Table 5: Definition of firm level variables

Variable	Code	Definition	AJPES CODE
Labour cost per worker	Lcost	Total labour costs per month divided by average number of workers	$\frac{AOP140}{AOP188 * AOP189} * 100$
Labour productivity	Lprod	(Net sales minus costs of materials and services per month) divided by average number of workers	$\frac{AOP110 \quad AOP128}{AOP188 * AOP189} * 100$
Capital intensity	Kint	Capital stock divided by average number of workers	$\frac{AOP50}{AOP188} * 100$
Employment	Empl	Number of workers	$\frac{AOP188}{100}$
Profit margin	PM	Gross revenue divided by operating expenses	$\frac{AOP126}{AOP127}$
Ownership concentration	C4	Sum of top 4 owners	
Cash-flow to control rights ratio	cf.cr	Largest direct owner's share divided by largest indirect owner's share	
Regional average labour costs	WREG	Average labour costs in a statistical region	
Sector average labour costs	WSKD	Average NACE level 3 labour costs	

Source: AJPES, 2011; own calculation

Before starting with the estimation of spatial parameters, which are of prime interest to this study, we estimated the following OLS model and later tested for presence of spatial correlation using diagnostic test in form of Lagrange multiplier test.

Estimated model was in the following form:

$$ln(Lcost) = \beta_0 + \beta_1\, ln(Empl) + \beta_2\, ln(Lprod) + \beta_3\, ln(KInt) + \beta_4\, ln(PM) + \beta_5\, ln(cf.cr) + \beta_6\, ln(C4) + \beta_7\, ln(WREG) + \beta_7\, ln(WSKD) + \varepsilon, \quad \varepsilon \sim N(0, \sigma^2) \qquad (8)$$

Table 6: Results of OLS model

	Estimate	Std. Error
Intercept	-3.909**	1.266
Employment	-0.027**	0.008
Labour productivity	0.277***	0.013
Capital intensity	0.016***	0.004
Profit margin	-0.292***	0.051
Cash-flow/control	-0.031*	0.014
Own. concentration	-0.085***	0.023
Regional labour c.	0.813***	0.178
Sector labour c.	0.457***	0.040
n	798	
S_e	0.204	
R^2	0.605	
Adjusted R^2	0.601	
F-statistic (p-value)	150.9 (0.000)	

Note:
*** stat. sign. at the 0.1% level
**stat. sign. at the 1% level
*stat. sign. at. the 5% level

Source: KDD, 2010; AJPES PRS, 2011; own calculation

Labour costs are positively correlated with the average regional and sector labour costs. Similar result is shown for the labour productivity and capital intensity. Increase in labour productivity by 1% raises labour costs on average by 0.28%, ceteris paribus. On the other hand, contrary to the expectation employment has a small, yet negative effect, which is not in line with the theory, since larger firms are expected to pay higher wages. Surprisingly, profits are also found to have negative effects on wage levels. So the question that arises is whether higher profits are made at the expense of underpaid labour. If owners are highly indebted due to takeovers, reducing the average labour costs and thus increasing the profitability might explain the negative relationship. Since we do not have enough data to answer this question, profit-wage relationship remains unsolved while it still indicates that this behaviour induced by owners is not sustainable. However, other variables related to ownership seem to indicate just that. Higher ownership concentration reveals a negative correlation to average labour costs. Increase of ownership concentration by 1% reduces average labour costs by 0.085%, which is not in accordance to the Cubbin and Leech (1983), who found a positive relationship between concentration and firm performance. Apparently pyramid structures make it easier to divert cash-flow from companies to owner's pockets so it leaves less for the wages. Decreasing the ratio of cash-flow to control rights by 1% is accompanied by the increase of average labour costs by 0.031% on average, ceteris paribus. In light of these two findings of negative effect of both ownership related variables to wages, profit-wage relationship as found in Slovenian sample no longer appears contradictory.

Testing for spatial correlation (Table 7) reveals that both residuals of OLS model and spatial lag of dependent variable are spatially correlated, meaning that we might expect similar values of both the dependent variable and disturbances in firms belonging to the same individual(s). This is a first indication in this study that ownership of a business does matter with regards to wages. Lagrange multiplier tests show that both lag of dependent variable as well as errors of OLS are spatially correlated, which signals that the data generating process takes a form of spatial error model.

Table 7: LM tests

	LM test
SARAR(0,1)	20.402***
SARAR(1,0)	5.543*
SARAR(1,1)	26.164***

Note:
*** stat. sign. at the 0.1% level
**stat. sign. at the 1% level
*stat. sign. at. the 5% level
Source: KDD, 2010; AJPES PRS, 2011; own calculation

In the case of spatial lag model, OLS estimates will be biased and inconsistent due to the simultaneity bias. On the other hand, if the true data generating process is spatial error model, in which the off-diagonal elements of the covariance matrix determine the structure of spatial dependence, OLS will remain unbiased, yet inefficient, since estimators for standard errors will be biased in small samples.

In Table 8 we present the results of SARAR models using spatial autocorrelation and heteroscedastic consistent estimator (FGS2SLS-HAC). Results were obtained using R software and the SPHET library (Piras, 2010).

Table 8: Results of spatial models

	SARAR(1,0)		SARAR(0,1)		SARAR(1,1)	
	Estimate	HAC St.Er.	Estimate	HAC St.Er.	Estimate	HAC St.Er.
Intercept	-3.980**	1.387	-4.150**	1.467	-4.065**	1.459
Employment	-0.032**	0.011	-0.032**	0.01	-0.031**	0.01
Labour productivity	0.252***	0.026	0.275***	0.029	0.246***	0.029
Capital intensity	0.013*	0.005	0.012*	0.005	0.012*	0.005
Profit margin	-0.289***	0.087	-0.289***	0.075	-0.289***	0.075
Cash-flow/control	-0.032***	0.009	-0.032*	0.014	-0.032*	0.014
Own. concentration	-0.073**	0.008	-0.072*	0.024	-0.074**	0.026
Regional labour c.	0.834***	0.185	0.858***	0.204	0.847***	0.202
Sector labour c.	0.460***	0.046	0.461***	0.051	0.459***	0.051
Lambda	0.003**	0.001	-	-	0.001	0.001
Rho	-	-	0.387***	0.085	0.401***	0.092
n	798		798		798	
S_e	0.203		0.160		0.157	
R^2	0.603		0.752		0.762	
Adjusted R^2	0.595		0.743		0.752	

Note:
*** stat. sign. at the 0.1% level
**stat. sign. at the 1% level
*stat. sign. at the 5% level

Source: KDD, 2010; AJPES PRS, 2011; own calculation

Although LM tests indicate that spatial error model is a proper specification of the given model, we nonetheless estimated the SARAR(1,1) model in order to confirm our previous findings. Looking only at the spatial parameters in the SARAR(1,1) model we can see that spatial lag is not statistically different from zero. For that reason we excluded it and estimated a spatial error model. Comparing results of the OLS model to the spatial error model does not reveal any significant changes to the estimates, although adjusted R^2 shows a better fit of the spatial error model compared to the OLS model. Adjusted R^2 in the case of OLS is 0.60 compared to 0.74 in the spatial error model. This is in line with our expectations, since we explicitly try to find ownership based effects in the disturbances. Coefficient of spatial autocorrelation of the disturbances, with value of 0.387, reveals positive moderate ownership effects on labour costs. Disturbances are not independently and identically distributed but exhibit similar values around each individual owner; values of disturbances are dependent on the position in the capital space. Since capital connectivity matrix was designed using individual ownership shares, this confirms that the identity of owners do matter, at least in the case of corporate wage policy in Slovenia.

6. Concluding remarks

This paper introduces the capital space and a capital connectivity matrix to the field of corporate governance. Although owners are usually seen as solely seeking highest returns on their investments, maximizing profits, it was therefore concluded that ownership is not an important factor. In this paper we provided empirical evidence that there is a non-negligible effect of ownership on corporate wage policy. We believe that past difficulties in providing such empirical evidence lies in the unavailability of detailed ownership structure data and a lack of appropriate methods. In this paper we used ownership data on individual level and spatial econometric techniques to show that ownership does matter in the case of corporate wage setting. It has been found that both ownership concentration and excess of cash-flow rights with regards to control rights have a detrimental effect on wages. Not only that, it has been found that identity of owners is also an important factor as firms with same owners similarly affect average labour costs even after controlling for standard factors such as labour productivity, employment, capital intensity and profitability. A surprising finding was a relationship between wages and profitability. Results indicate that firms with higher profits (ceteris paribus) pay lower wages. We argue that this effect could be explained by highly indebted owners, seeking higher returns on their investment by reducing labour costs.

One limitation needs to be acknowledged and addressed regarding the present study. Using a cross-sectional data does not enable us to distinguish between the true effects of the owners from their selection. It is possible that individuals invest in firms that reflect some similarities in wage levels; hence spatial error might reflect their investment decision patterns and not their effects on corporate policies, which is what the further research will reveal. Also, a finding that a presence of a specific individual owner in a group of firms shows resemblance in their wage levels gives ground to studying effects of ownership on other corporate policies.

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